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MRSA colonisation (eradicating colonisation in people without active/invasive infection)

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ABSTRACT

INTRODUCTION: Methicillin-resistant Staphylococcus aureus (MRSA) has a gene that makes it resistant to methicillin as well as to other beta-lactam antibiotics, including flucloxacillin, beta-lactam/beta-lactamase inhibitor combinations, cephalosporins, and carbapenems. MRSA can be part of the normal body flora (colonisation), especially in the nose, but it can cause infection. Until recently, MRSA has primarily been a problem associated with exposure to the healthcare system, especially in people with prolonged hospital admissions, with underlying disease, or after antibiotic use. In many countries worldwide, a preponderance of S aureus bloodstream isolates are resistant to methicillin. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical question: What are the effects of treatment for MRSA nasal or extra-nasal colonisation? We searched: Medline, Embase, The Cochrane Library, and other important databases up to January 2010 (Clinical Evidence reviews are updated periodically, please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 9 systematic reviews, RCTs, or observational studies that met our inclusion criteria. CONCLUSIONS: In this systematic review we present information relating to the effectiveness and safety of the following interventions: antiseptic body washes, chlorhexidine–neomycin nasal cream, mupirocin nasal ointment, systemic antimicrobials, tea tree oil preparations, and other topical antimicrobials.

QUESTIONS

INTERVENTIONS

Key points

- Methicillin-resistant *Staphylococcus aureus* (MRSA) has a gene that makes it resistant to methicillin as well as other beta-lactam antibiotics, including flucloxacillin, cephalosporins, and carbapenems.

  MRSA can be part of the normal body flora (colonisation), especially in the nose, but it can cause infection, especially in people with prolonged hospital admissions, with underlying disease, or after antibiotic use.

  Bloodstream infection due to MRSA is an all-too-common problem worldwide.

- Mupirocin nasal ointment may improve eradication of colonised MRSA compared with placebo, and may be as effective as topical fusidic acid plus oral trimethoprim–sulfamethoxazole (co-trimoxazole) and more effective than tea tree oil, although studies have given conflicting results.

  We don't know whether antiseptic body washes, chlorhexidine–neomycin nasal cream, other topical antimicrobials, or systemic antimicrobials are effective at clearing MRSA colonisation.

DEFINITION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is an organism resistant to methicillin by means of the *mecA* gene. This confers resistance to all beta-lactam antibiotics, including flucloxacillin, oxacillin, cephalosporins, and carbapenems. Antimicrobial resistance is defined as the failure of the antimicrobial to reach a concentration in the infected tissue high enough to inhibit the growth of the infecting organism. MRSA presents in the same way as susceptible *S aureus*. It can be part of the normal flora (colonisation), or it can cause infection. The phenomena of colonisation and infection should be treated as separate entities. In many countries worldwide, a preponderance of *S aureus* bloodstream isolates are resistant to methicillin. **MRSA colonisation:** growth of MRSA from a body fluid or swab from any body site. The most common site of colonisation is the anterior nares, but MRSA can also be found in other areas such as the axillae, abnormal skin (e.g., eczema, wounds), urine, rectum, and throat. There should be no signs or symptoms of infection. The colonised site may act as a reservoir of MRSA, which then causes infection at another site or can be passed on to others. Although the colonised patient (or staff member) does not need treatment, a course of decolonisation treatment may be given in order to eradicate carriage and prevent future infections or transmission. [1] [2] In this review, we have included adults aged 18 years or older in hospitals and residential homes, outpatients, and healthcare workers.

INCIDENCE/ PREVALENCE

The incidence of MRSA varies from country to country. [3] [4] The UK, Ireland, and southern Europe (e.g., Spain, Italy, and Greece) have a high incidence when compared with northern Europe and Scandinavia. The most objective measure of incidence is the percentage of *S aureus* found in blood cultures that are resistant to methicillin. Rates may exceed 40% in many countries. [5]

AETIOLOGY/ RISK FACTORS

Traditional risk factors for MRSA colonisation include: prolonged stay in hospital, severe underlying disease, prior antibiotics, exposure to colonised people, and admission to a high risk unit (critical care, renal unit, etc). MRSA has primarily been a problem associated with exposure to the healthcare system. More recently, MRSA strains have emerged in the community (so-called community-associated MRSA [CA-MRSA] strains) that have no relationship with healthcare-related strains. These strains may colonise and cause infection among young, healthy people. [4]

PROGNOSIS

The virulence, or ability, of MRSA to cause death and severe infection seems to be greater than that of methicillin-susceptible *S aureus* strains. [2] [4] A meta-analysis of 31 cohort studies found that mortality associated with MRSA bacteraemia was significantly higher than that of methicillin-susceptible *S aureus* bacteraemia (mean mortality not reported; OR 1.93, 95% CI 1.54 to 2.42). [6]

AIMS OF INTERVENTION

To reduce the number of people colonised with MRSA, or MRSA infection, with minimal adverse effects of treatment.

OUTCOMES

MRSA eradication rates, adverse effects of treatment.

METHODS

Clinical Evidence search and appraisal January 2010. The following databases were used to identify studies for this systematic review: Medline 1966 to January 2010, Embase 1980 to January 2010, and The Cochrane Database of Systematic Reviews 2009, Issue 4 (1966 to date of issue). An additional search within the Cochrane Library was carried out for the Database of Abstracts of Reviews of Effects (DARE) and Health Technology Assessment (HTA). We also searched for retractions of studies included in the review. Abstracts of the studies retrieved from the initial search were assessed by an information specialist. Selected studies were then sent to the contributor for additional assessment, using pre-determined criteria to identify relevant studies. Study design criteria for inclusion in this review were: published systematic reviews of RCTs, and RCTs in any language containing more than 20 individuals of whom more than 80% were followed up. We included studies whatever the level of blinding (including open). There was no minimum length of follow-up required to include studies. However, we preferentially report outcomes at 1 month or greater, and only include outcomes of less than 1 month if the same outcome is not reported at 1 month or longer. We included systematic reviews of RCTs and RCTs where harms of an included intervention were studied applying the same study design criteria for inclusion as we did for benefits. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the FDA and the MHRA, which are added to the reviews as required. To aid readability of the numerical data in our reviews, we round many percentages to the nearest whole number. Readers should be aware of this when relating percentages to summary statistics such as relative risks (RRs) and odds ratios (ORs). We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 9). The categorisation of the quality of the evidence (into high, moderate, low, or very low) reflects the quality of evidence available for our chosen outcomes in our defined populations of interest. These categorisations are not necessarily a reflection of the overall methodological quality of any individual study, because the *Clinical Evidence* population and outcome of choice may represent only a small subset of the total outcomes reported, and population included, in any individual trial. For further details of how we perform the GRADE evaluation and the scoring system we use, please see our website (www.clinicalevidence.com).

QUESTION What are the effects of treatment for MRSA nasal or extra-nasal colonisation in adults?

OPTION MUPIROCIN NASAL OINTMENT

MRSA eradication

Compared with placebo Mupirocin nasal ointment may be more effective at reducing the proportion of people colonised with MRSA at the end of trial follow-up (very low-quality evidence).

Compared with topical fusidic acid plus oral trimethoprim–sulfamethoxazole We don't know whether mupirocin nasal ointment is more effective at increasing eradication of MRSA colonisation for people in intensive care units or a surgical unit (very low-quality evidence).

Compared with tea tree oil preparations Mupirocin nasal ointment plus chlorhexidine skin cleanser plus silver sulfadiazine cream may be more effective than tea tree oil cream plus tea tree oil body wash at eradicating MRSA nasal colonisation at 14 days, but not in eradicating MRSA colonisation from all sites. We don't know whether mupirocin nasal ointment plus triclosan body wash is more effective than tea tree oil nasal ointment plus tea tree body wash at eradicating MRSA colonisation at any body site (very low-quality evidence).

Note
Long-term evaluation of eradication treatment has proved to be difficult owing to a high attrition rate in most of the trials.

For GRADE evaluation of interventions for MRSA, see table, p 9 .

Benefits:

Mupirocin nasal ointment versus placebo:
We found three systematic reviews (search date 2003, 1 RCT; [7] search date 2008, 2 RCTs; [8] search date 2008, 3 RCTs [9]). Neither the first nor the second systematic review performed a meta-analysis. [7] [8] The third review included RCTs identified by the first two reviews and pooled data. [9] We have, therefore, reported this review in detail. The third review included RCTs both of MRSA and methicillin-susceptible *S aureus* (MSSA). We have only reported data on the three MRSA RCTs here (see comment). The review reported that all three included RCTs found higher eradication rates with mupirocin after 1 week or at the end of treatment. The first included RCT (98 people with MRSA) included inpatients and compared mupirocin nasal ointment plus chlorhexidine body wash versus placebo nasal ointment plus chlorhexidine body wash. Duration of follow-up was 26 weeks, and cultures were taken from nose, groin, urine, and wounds. The review reported that MRSA eradication at the end of follow-up was 25% in mupirocin group versus 18% in the placebo group (statistical analysis between groups not reported). The second included cluster-randomised RCT (134 healthy soldiers with community-acquired MRSA on a healthcare specialist course [combat medics]) compared mupirocin nasal ointment versus placebo nasal ointment. Duration of follow-up was 56 weeks and cultures were taken from the nose. The review reported the eradication rate at the end of follow-up was 88% with mupirocin versus 65% with placebo (statistical analysis between groups not reported). The third included RCT was undertaken with people in a long-term care facility and compared mupirocin nasal ointment versus placebo nasal ointment. This RCT included 63 people with MRSA and 64 people with MSSA. Duration of follow-up was 16 weeks and cultures were taken from the nose and wounds. Eradication rate after 1 week was 93% with mupirocin versus 15% with placebo, and eradication rate at the end of follow-up was 88% with mupirocin versus 18% with placebo (statistical analysis between groups not reported). Treatment duration ranged from 5 to 14 days in the three RCTs. In its primary analysis, the review pooled data for MRSA and MSSA carriage combined. We have not reported these data here (see comment below). In a subgroup analysis of MRSA carriage alone, the review found that mupirocin significantly reduced the risk of treatment failure compared with placebo at the end of the follow-up period (2 RCTs [not identified by the review]; RR 0.71, 95% CI 0.55 to 0.90; absolute results not reported). There was heterogeneity among the RCTs (I^2 90.2%; P value for heterogeneity not reported). The treatment effect varied between the two RCTs included in the analysis (first RCT undertaken in patients: RR 0.91, 95% CI 0.74 to 1.13; second RCT undertaken in healthy carriers: RR 0.29, 95% CI 0.13 to 0.68). [9]

Mupirocin nasal ointment versus topical fusidic acid plus oral trimethoprim–sulfamethoxazole (co-trimoxazole; TMP–SMX):
We found one systematic review (search date 2003, 1 RCT, 84 people colonised with MRSA of the nares [54% had extra-nasal colonisation; 32% had MRSA infection] in intensive care units or a surgical unit; mean age 54 years). [7] The RCT identified by the review found that nearly all people in either group were eradicated of MRSA over 90 days with calcium mupirocin (2% 3 times/day for 5 days) or with topical fusidic acid (2% 3 times/day plus oral trimethoprim–sulfamethoxazole once daily) (eradication of MRSA from only nasal site 4 weeks after treatment started: 23/24 [96%] with calcium mupirocin *v* 18/19 [95%] topical fusidate plus TMP–SMX; RR 1.01, 95% CI 0.88 to 1.16).

Mupirocin nasal ointment versus tea tree oil preparations:
See benefits of tea tree preparations, p ? .

Longer versus shorter treatment with mupirocin nasal ointment:
We found no systematic review or RCTs.

Harms:

Mupirocin nasal ointment versus placebo:
The first systematic review reported low level resistance to mupirocin in both groups (11/48 [23%] with calcium mupirocin *v* 12/50 [24%] with placebo; significance assessment not reported). [7] No resistance to the eradicating agents developed during the one RCT which looked for this outcome. [10] The third systematic review that included RCTs in people with MRSA or MSSA reported that

acquisition of mupirocin resistance during treatment was found in 6/714 (1%) people in 12 studies, and reported that adverse effects attributable to mupirocin use were mild and did not lead to discontinuation of therapy. [9]

Mupirocin nasal ointment versus topical fusidic acid and oral TMP-SMX:
Mild discomfort was reported with both mupirocin and fusidic acid nasal ointments but absolute numbers were not given. [7] No other adverse events were detected, although serious adverse effects have been associated with oral TMP-SMX. [11]

Mupirocin nasal ointment versus tea tree oil preparations:
See harms of tea tree preparations, p ? .

Longer versus shorter treatment with mupirocin nasal ointment:
We found no RCTs.

Comment: The third review in its primary analysis included the outcome of MSSA eradication (6 RCTs in people all with MSSA, or vast majority with MSSA) as well as MRSA eradication (3 RCTs in people all with MRSA, or at least 50% with MRSA). [9] In this analysis, it found that mupirocin significantly reduced the risk of MRSA and MSSA carriage compared with placebo at 16 to 365 days (9 RCTs; RR 0.44, 95% CI 0.39 to 0.50; absolute numbers not reported). [9] However, in these data, the majority of people had MSSA, the analysis included a variety of population groups (patients, healthcare workers, people with HIV, healthy soldiers [combat medics], people in long-term care facilities), and there was marked heterogeneity among RCTs (I^2 90.2%; P value for heterogeneity not reported). Hence, these data should be viewed with caution.

Long-term evaluation of eradication treatment has proved to be difficult owing to a high attrition rate in most of the trials.

OPTION ANTISEPTIC BODY WASHES

MRSA eradication
Compared with placebo We don't know whether chlorhexidine body wash is more effective than placebo body wash at increasing the proportion of people without MRSA colonisation in people also receiving nasal mupirocin ointment and oral mouth rinses (low-quality evidence).

For GRADE evaluation of interventions for MRSA, see table, p 9 .

Benefits: **Antiseptic body wash versus placebo:**
We found one systematic review (search date 2008), [8] which included one RCT (114 people). [12] The RCT included adults who were MRSA-positive inpatients, outpatients, and residents of nursing homes, and compared 4% chlorhexidine body wash versus placebo (water with polysorbate 20, similar to treatment solution in appearance and smell). [9] In addition, all people received intranasal mupirocin ointment three times a day for 5 days and oral chlorhexidine rinses twice daily. Swabs were taken from multiple sites, and results were based on 103/114 (90%) people randomised. [12] The RCT found no significant difference between groups in MRSA carriage at 30 days (proportion of people without colonisation: 4/48 [8%] with chlorhexidine *v* 7/55 [13%] with placebo; OR 0.62, 95% CI 0.14 to 2.60; P = 0.47). The RCT reported that, compared with those colonised at only one body site, people colonised at more than one body site were significantly more likely to fail eradication (OR 11.42, 95% CI 2.08 to 82.75; P = 0.002). [12] The RCT noted that nearly half the participants (47%) had wounds, which may have been a reason for the low success rate.

Harms: **Antiseptic body wash versus placebo:**
The RCT found that, compared with placebo, chlorhexidine body wash significantly increased the proportion of people with skin fissures, pruritus, and burning of the skin (skin fissures: 17.7% with chlorhexidine *v* 1.8% with placebo; P = 0.01; pruritus: 41.5% with chlorhexidine *v* 10.9% with placebo; P = 0.001; burning of the skin: 50.0% with chlorhexidine *v* 9.1% with placebo; P <0.001). [12] People who were treated with chlorhexidine washes were more likely to withdraw from the trial because of adverse events compared with people receiving placebo, but the difference between groups was not statistically significant (P = 0.18). The RCT reported that most adverse events resolved within 48 hours. [12]

Comment: None.

OPTION CHLORHEXIDINE–NEOMYCIN NASAL CREAM

We found no direct information from RCTs on the effects of chlorhexidine–neomycin nasal cream in people with MRSA nasal or extra-nasal colonisation.

For GRADE evaluation of interventions for MRSA, see table, p 9 .

Benefits: We found no systematic review or RCTs.

Harms: We found no RCTs.

Comment: None.

OPTION SYSTEMIC ANTIMICROBIALS

MRSA eradication

Systemic antimicrobials compared with each other We don't know whether trimethoprim–sulfamethoxazole plus rifampicin is more effective than rifampicin plus novobiocin at increasing eradication of MRSA colonisation of all body sites at 14 days (low-quality evidence).

Oral trimethoprim–sulfamethoxazole (co-trimoxazole; TMP–SMX) plus topical fusidic acids compared with mupirocin nasal ointment We don't know whether oral TMP–SMX plus topical fucidic acid is more effective at increasing eradication of MRSA colonisation in people from intensive care units or a surgical units (very low-quality evidence).

Note

We found no clinically important results about systemic antimicrobials compared with placebo in people with MRSA nasal or extra-nasal colonisation.

For GRADE evaluation of interventions for MRSA, see table, p 9 .

Benefits:

Systemic antimicrobials versus placebo:

We found two systematic reviews (search date 2003, 2 RCTs; [7] search date 2008, 2 RCTs [9]). The two RCTs were common to both reviews (first RCT: 16 people in an intensive care unit with MRSA colonisation of the nose, throat, or skin, comparing oral fusidic acid *v* placebo; second 4-armed RCT: 35 people in a long-term care facility with MRSA colonisation of the nose, comparing rifampicin *v* placebo, minocycline *v* placebo, rifampicin plus minocycline *v* placebo). Both systematic reviews performed a meta-analysis and found small sample sizes for individual studies and variable lengths of follow-up. Combining the results of many agents in this way may give misleading results, as the action of each antibiotic is different and they would not necessarily have equal efficacy. The combined results are not presented here. No firm conclusions could be drawn from the results of the individual RCTs (most of the individual trial arms included <10 participants).

Systemic antimicrobials versus each other:

We found three systematic reviews (search date 2003, 3 RCTs; [7] search date 2006, 3 RCTs; [13] search date 2008, 3 RCTs [9]). The three RCTs (182 people) were common to all three systematic reviews. Two systematic reviews performed a meta-analysis. [7] [9] The results from the RCTs were pooled comparing different antimicrobials versus each other (rifampicin *v* minocycline; rifampicin *v* minocycline *v* rifampicin plus minocycline; novobiocin plus rifampicin *v* trimethoprim–sulfamethoxazole [co-trimoxazole; TMP–SMX] plus rifampicin; ciprofloxacin plus rifampicin *v* TMP–SMX). [7] [9] Combining the results of many agents in this way may give misleading results as the action of each antibiotic is different and they would not necessarily have equal efficacy. Consequently, no firm conclusion could be reached from the results of the reviews and the results are not presented here. The largest RCT identified by the review (126 people aged 18–94 years with MRSA colonisation [but not infected] of non-infected wounds, nose, tracheotomy sites, other stomal sites, or respiratory secretions) included sufficient numbers of people to be analysed individually. [14] The RCT found no significant difference in the rate of MRSA eradication between novobiocin (500 mg oral 12 hourly) plus rifampicin (300 mg oral 12 hourly) for 7 days compared with TMP–SMX (160 mg/800 mg oral 12 hourly) plus rifampicin (300 mg oral 12 hourly) for 7 days (eradication of MRSA from all colonised body sites at day 14 after treatment: 30/45 [67%] with novobiocin plus rifampicin *v* 26/49 [53%] with TMP–SMX plus rifampicin; RR 1.26, 95% CI 0.90 to 1.76). [7]

Oral TMP-SMX plus topical fusidic acid versus mupirocin nasal ointment:

See benefits of mupirocin nasal ointment, p ? .

Harms:

Systemic antimicrobials versus placebo:

The systematic review reported that no adverse events were reported in the RCTs. [7]

Systemic antimicrobials versus each other:

The systematic review reported that in one RCT, 2/41 (5%) people had nausea with TMP–SMX. In a second RCT, 1/45 (2%) people had elevated bilirubin levels and 1/45 (2%) had a rash with novobiocin plus rifampicin; and 1/49 (2%) people had leukopenia with TMP–SMX plus rifampicin. In a third RCT, 1/11 (9%) people with ciprofloxacin plus rifampicin and 2/10 (9%) people with

TMP–SMX plus rifampicin stopped treatment early owing to nausea and vomiting; and 1/11 (9%) people with ciprofloxacin plus rifampicin and 2/10 (20%) people with TMP–SMX plus rifampicin developed elevations in liver function tests that resolved on completion of treatment. [7] [13] The included RCT that contained sufficient people to be analysed individually found that significantly more people developed resistance to rifampicin with novobiocin plus rifampicin compared with TMP–SMX plus rifampicin (7/49 [14%] with novobiocin plus rifampicin *v* 1/45 [2%] with TMP–SMX plus rifampicin; OR 7.33 [CI not reported]; P = 0.04). [14]

Topical fusidic acid plus oral TMP–SMX versus mupirocin nasal ointment:
See harms of mupirocin nasal ointment, p ? .

Comment: None.

OPTION TEA TREE OIL PREPARATIONS

MRSA eradication
Compared with mupirocin Tea tree oil cream plus tea tree oil body wash may be less effective than mupirocin nasal ointment plus chlorhexidine skin cleanser plus silver sulfadiazine cream at eradicating MRSA nasal colonisation at 14 days, but not in eradicating MRSA colonisation from all sites. We don't know whether tea tree oil nasal ointment plus tea tree oil body wash is more effective than mupirocin nasal ointment plus triclosan body wash at eradicating MRSA colonisation at any body site (very low-quality evidence).

Note
We found no direct information on tea tree oil preparations versus placebo in people with MRSA nasal or extra-nasal colonisation.

For GRADE evaluation of interventions for MRSA, see table, p 9 .

Benefits:

Tea tree (*Melaleuca alternifolia*) oil preparations versus placebo:
We found no systematic review or RCTs.

Tea tree oil preparations versus mupirocin:
We found two systematic reviews (search date 2004, 2 RCTs, 266 people; [15] search date 2008, 1 RCT, 236 people [9]), which did not include a meta-analysis. One RCT (236 people) was identified by both reviews. The first RCT (30 people infected or colonised by MRSA in an acute referral teaching hospital, body sites not reported; 13/30 [43%] people lost to follow-up) found no significant difference in the rate of MRSA eradication (undefined) for tea tree oil nasal ointment 4% plus tea tree oil body wash 5% for a mean of 10.7 days (range 1–34 days; frequency of use unclear) compared with mupirocin nasal ointment 2% plus triclosan body wash for a mean of 5.6 days (range 2–14 days; frequency of use unclear) (eradication of MRSA from nose, perineum, and any previously positive site: 5/15 [33%] with tea tree oil *v* 2/15 [13%] with mupirocin nasal ointment; P = 0.235). [15] The small number of people in the first RCT means that it was not powered to detect a slight, but clinically significant, difference between tea tree oil preparations and mupirocin. [15] The second RCT (236 people colonised by MRSA in an acute district general hospital) compared tea tree oil cream (10% to nares 3 times/day and lesions once/day) plus tea tree oil body wash (5% daily for 5 days) versus mupirocin nasal ointment (2% to nares 3 times/day) plus chlorhexidine skin cleanser (daily) plus silver sulfadiazine cream (1% to lesions daily for 5 days). [15] It found that tea tree oil was significantly less effective in eradication of nasal colonisation compared with mupirocin nasal ointment 14 days after treatment (36/76 [47%] with tea tree oil *v* 58/74 [78%] with mupirocin nasal ointment; P <0.001). However, it found no significant difference between tea tree oil compared with mupirocin in eradication of MRSA from all sites 14 days after treatment (eradication from nose, throat, axillae, groin, and skin lesions: 46/110 [42%] with tea tree oil *v* 56/114 [49%] with mupirocin nasal ointment; P = 0.286). [15]

Harms:

Tea tree oil preparations versus placebo:
We found no RCTs.

Tea tree oil preparations versus mupirocin:
The systematic reviews did not report on adverse effects. [9] [15]

Comment: None.

OPTION TOPICAL ANTIMICROBIALS OTHER THAN MUPIROCIN NASAL OINTMENT, ANTISEPTIC BODY WASHES, CHLORHEXIDINE-NEOMYCIN NASAL CREAM, AND TEA TREE OIL PREPARATIONS New

We found no direct information from RCTs on the effects of topical antimicrobials other than mupirocin nasal ointment, antiseptic body washes, chlorhexidine-neomycin nasal cream, and tea tree oil preparations in people with MRSA nasal or extra-nasal colonisation.

For GRADE evaluation of interventions for MRSA, see table, p 9 .

Benefits:

Other topical antimicrobials versus placebo:
We found no systematic review or RCTs.

Other topical antimicrobials versus systemic antimicrobials:
We found no systematic review or RCTs.

Other topical antimicrobials versus mupirocin:
We found no systematic review or RCTs.

Harms:

Other topical antimicrobials versus placebo:
We found no RCTs.

Other topical antimicrobials versus systemic antimicrobials:
We found no RCTs.

Other topical antimicrobials versus mupirocin:
We found no RCTs.

Comment: In this option we have reported any studies on topical antimicrobials that we found other than studies on mupirocin nasal ointment, antiseptic body washes, chlorhexidine–neomycin nasal cream, and tea tree oil preparations, which we have reported separately.

GLOSSARY

Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low-quality evidence Any estimate of effect is very uncertain.

SUBSTANTIVE CHANGES

Topical antimicrobials other than mupirocin nasal ointment, antiseptic body washes, chlorhexidine-neomycin nasal cream, and tea tree oil preparations New option. Categorised as unknown effectiveness, as we found no RCT evidence to assess its effects.

Antiseptic body washes New evidence added. [8] [12] Categorisation unchanged (unknown effectiveness) as there remains insufficient evidence to judge the effects of this intervention.

Mupirocin nasal ointment New evidence added. [8] [9] Categorisation unchanged (likely to be beneficial).

Systemic antimicrobials New evidence added. [9] [13] Categorisation unchanged (unknown effectiveness) as there remains insufficient evidence to judge the effects of this intervention.

Tea tree oil preparations New evidence added. [9] Categorisation changed from Unlikely to be beneficial to Unknown effectiveness.

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Competing interests: SFB has been reimbursed by GlaxoSmithKline as a consultant regarding the development of vaccines.

Disclaimer

TABLE **GRADE evaluation of interventions for MRSA colonisation (eradicating colonisation in people without active/invasive infection)**

Important outcomes	**MRSA eradication, adverse effects.**								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
What are the effects of treatment for MRSA nasal or extra-nasal colonisation in adults?									
3 (295) [7] [8] [9]	MRSA eradication	Mupirocin nasal ointment *v* placebo	4	–1	–1	–2	0	Very low	Quality point deducted for incomplete reporting of results. Consistency point deducted for statistical heterogeneity among RCTs. Directness points deducted for co-intervention in 1 RCT (chlorhexidine body wash) and inclusion of people with MSSA in 1 RCT
1 (43) [7]	MRSA eradication	Mupirocin nasal ointment *v* oral trimethoprim–sulfamethoxazole plus topical fusidic acid	4	–2	0	–2	0	Very low	Quality points deducted for sparse data and incomplete reporting of results. Directness points deducted for highly selected population (ITU/surgical unit) and inclusion of people with MRSA infection
1 (103) [8] [12]	MRSA eradication	Antiseptic body wash *v* placebo	4	–1	0	–1	0	Low	Quality point deducted for sparse data. Directness point deducted for use of co-intervention (mupirocin, oral rinses)
1 (94) [7] [9] [13] [14]	MRSA eradication	Systemic antimicrobials *v* each other	4	–1	0	–1	0	Low	Quality point deducted for sparse data. Directness point deducted for small number of comparators
2 (254) [9] [15]	MRSA eradication	Tea tree oil preparations *v* mupirocin	4	–2	–1	–-2	0	Very low	Quality points deducted for poor follow-up and unclear population (colonised or infected) in 1 RCT. Consistency point deducted for inconsistent results depending on outcome used (nose or all body sites). Directness points deducted for unclear intervention (regimen used) in 1 RCT and use of co-interventions in 2 RCTs

Type of evidence: 4 = RCT Consistency: similarity of results across studies.
Directness: generalisability of population or outcomes.
Effect size: based on relative risk or odds ratio.